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BELTZVILLE LAKE CARBON COUNTY, PENNSYLVANIA

Pacific Northwest Environmental
Research Laboratory

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
BELTZVILLE LAKE
CARBON COUNTY
PENNSYLVANIA
EPA REGION III
WORKING PAPER No. 414

WITH THE COOPERATION OF THE
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
AND THE
PENNSYLVANIA NATIONAL GUARD
JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Pennsylvania Department of Environmental Resources for professional involvement and to the Pennsylvania National Guard for conducting the tributary sampling phase of the Survey.

Walter A. Lyon, Director of the Bureau of Water Quality Management, Richard M. Boardman, Chief of the Division of Water Quality, and James T. Ulanoski, Aquatic Biologist of the Division of Water Quality, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

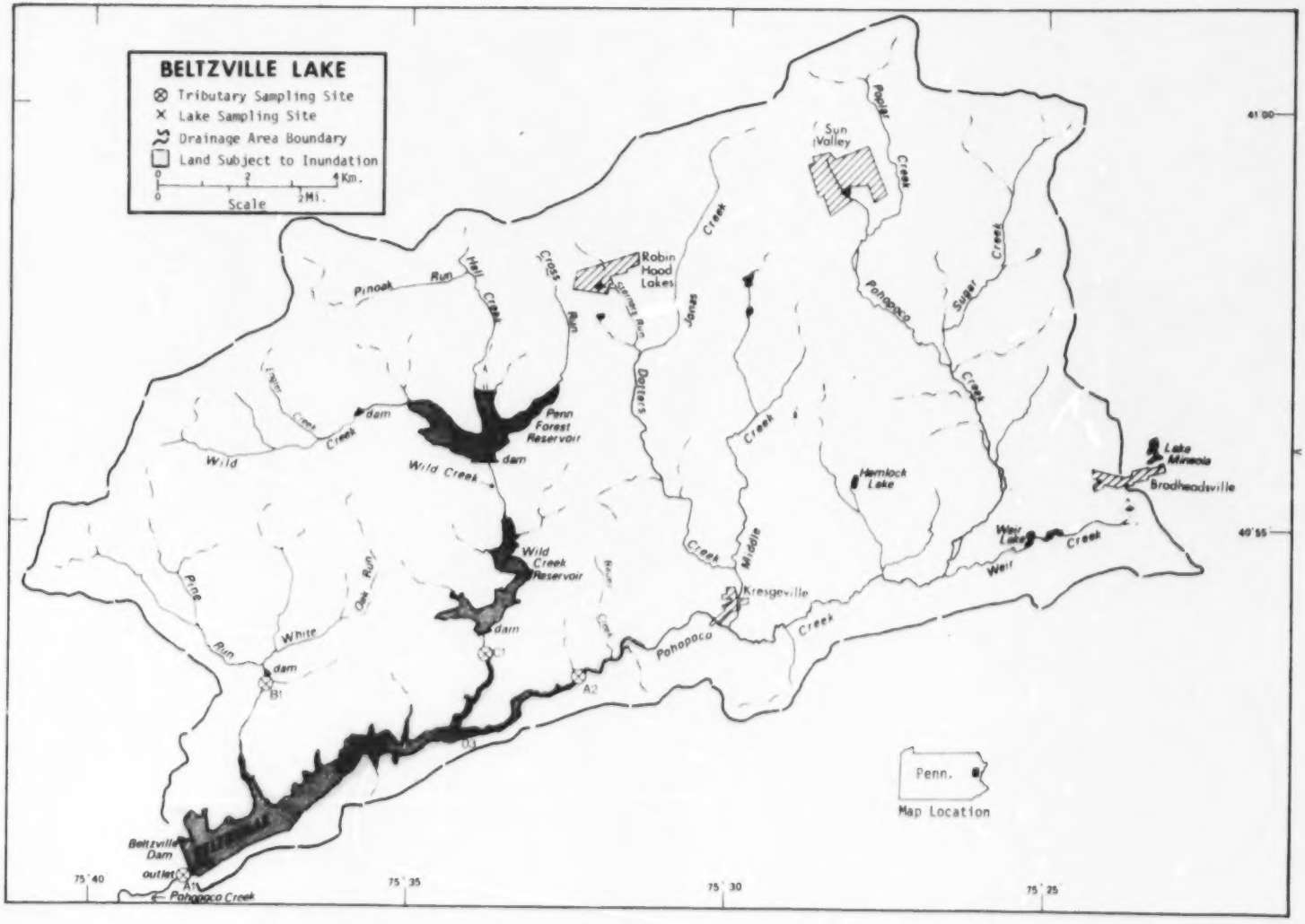
Major General Harry J. Mier, Jr., the Adjutant General of Pennsylvania, and Project Officer Major Ronald E. Wickard, who directed the volunteer efforts of the Pennsylvania National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF PENNSYLVANIA

LAKE NAME	COUNTY
Allegheny Reservoir	McKean, Warren, PA; Cattarugus, NY
Beaver Run Reservoir	Westmoreland
Beltzville	Carbon
Blanchard Reservoir	Centre
Canadohta	Crawford
Conneaut	Crawford
Conewago (Pinchot)	York
Greenlane	Montgomery
Harveys	Luzerne
Indian	Somerset
Naomi	Monroe
Ontelaunee	Berks
Pocono	Monroe
Pymatuning Reservoir	Crawford, PA; Ashtabula, OH
Shenango River Reservoir	Mercer
Stillwater	Monroe
Wallenpaupack	Pike, Wayne


BELTZVILLE LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
Land Subject to Inundation
0 2 4 Km.
0 1 2 Mi.
Scale
Penn. Map Location
Sun Valley
Robin Hood Lakes
Penn Forest Reservoir
Wild Creek Reservoir
Hemlock Lake
Lake Minsi
Bradheadsville
Kresgeville
Beltzville Dam
outlet
Pohopoco Creek
Pinook Run
Hell Creek
Cross Run
Stevens Run
Jones Creek
Poplar Creek
Pohopoco Creek
Sugar Creek
Deisers Creek
Middle Creek
Weir Creek
Wild Creek
Pine Run
White Oak Run
dam
A1
A2
B1
C1
D1
41°00
40°55
75°40
75°35
75°30
75°25

BELTZVILLE LAKE*

STORET NO. 4220

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Beltzville Lake is mesotrophic. Beltzville Lake ranked second in overall trophic quality when the 17 Pennsylvania lakes sampled in 1973 were compared using a combination of six lake parameters**. Two of the lakes had less median total phosphorus, one had less and three had the same median dissolved phosphorus, 11 had less median inorganic nitrogen, none had less mean chlorophyll a, and only one had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at stations 1 and 2 in July and October, 1973.

Survey limnologists did not observe any algal concentrations or rooted aquatic vegetation during their visits and commented on the attractive appearance of the lake.

B. Rate-Limiting Nutrient:

The algal assay results indicate that primary productivity in Beltzville Lake was phosphorus limited at the time the sample was taken (04/17/73). The lake data indicate phosphorus limitation at the other sampling times as well.

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* Table of metric conversions--Appendix A.
** See Appendix B.

C. Nutrient Controllability:

1. Point sources--There were no known point sources impacting Beltzville Lake during the sampling year. The present loading rate of 0.55 $g/m^2/yr$ is essentially the same as that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic rate (see page 12). If this low phosphorus loading rate can be maintained, the existing excellent water quality of Beltzville Lake should persist.

2. Non-point sources--The mean annual phosphorus loads from the two gaged tributaries amounted to 77.4% of the total load reaching the lake. The estimated phosphorus load from the ungaged drainage areas amounted to 19.5% of the total load.

The phosphorus export rates of the two gaged tributaries (see page 12) were comparable to the rates of unimpacted Pennsylvania tributaries surveyed elsewhere; e.g., Wagner Run (14 kg $P/km^2/yr$) and Upper Tunkhannock Creek (10 kg $P/km^2/yr$), tributaries of nearby Pocono Lake*.

* Working Paper No. 424.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 3.83 kilometers^2.
2. Mean depth: 12.8 meters.
3. Maximum depth: >36.9 meters.
4. Volume: 49.024 x 10^6 m^3.
5. Mean hydraulic retention time: 138 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Pohopoco Creek	129.2	2.7
Pine Run	19.0	0.5
Wild Creek	60.3	0.0
Minor tributaries & immediate drainage -	37.4	0.6
Total	245.9	3.8

2. Outlet -

Pohopoco Creek	249.7**	4.1

C. Precipitation***:

1. Year of sampling: 144.1 centimeters.
2. Mean annual: 120.7 centimeters.

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† Ulanoski, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Beltzville Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 36.9 meters at station 1, 22.9 meters at station 2, and 12.8 meters at station 3.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR BELTZVILLE DAM
STORET CODE 4220

PARAMETER	1ST SAMPLING (4/17/73) 3 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/24/73) 3 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/ 4/73) 3 SITES RANGE	MEAN	MEDIAN
TEMP (C)	7.8 - 11.3	9.1	8.9	8.4 - 26.2	20.1	20.5	11.9 - 19.2	17.3	18.3
DISS OXY (MG/L)	11.0 - 11.8	11.5	11.5	1.3 - 8.8	6.0	5.9	0.4 - 8.0	5.1	6.2
CNDCTVY (MCROMO)	50. - 60.	54.	55.	32. - 41.	39.	40.	42. - 54.	45.	44.
PH (STAND UNITS)	7.0 - 7.6	7.3	7.3	6.0 - 8.4	6.6	6.3	6.0 - 6.7	6.3	6.2
TOT ALK (MG/L)	10. - 14.	11.	10.	10. - 10.	10.	10.	10. - 24.	13.	13.
TOT P (MG/L)	0.008 - 0.014	0.010	0.010	0.008 - 0.021	0.012	0.012	0.009 - 0.027	0.012	0.010
ORTHO P (MG/L)	0.002 - 0.008	0.005	0.004	0.002 - 0.010	0.005	0.004	0.004 - 0.016	0.006	0.006
NO2+NO3 (MG/L)	0.800 - 0.990	0.876	0.860	0.400 - 0.850	0.568	0.620	0.040 - 0.800	0.523	0.525
AMMONIA (MG/L)	0.030 - 0.040	0.034	0.030	0.000 - 0.340	0.116	0.090	0.050 - 0.470	0.120	0.080
KJEL N (MG/L)	0.200 - 0.500	0.257	0.200	0.200 - 0.500	0.293	0.300	0.200 - 0.800	0.425	0.400
INORG N (MG/L)	0.830 - 1.030	0.910	0.890	0.480 - 0.940	0.684	0.740	0.510 - 0.910	0.643	0.615
TOTAL N (MG/L)	1.000 - 1.300	1.133	1.140	0.600 - 1.150	0.861	0.880	0.720 - 1.280	0.948	0.960
CHLRPYL A (UG/L)	3.3 - 5.2	4.3	3.1	5.7 - 8.4	6.8	6.2	2.8 - 3.5	3.3	3.5
SECCHI (METERS)	3.0 - 3.7	3.3	3.0	2.7 - 3.4	2.9	2.7	4.0 - 4.6	4.3	4.3

B. Biological characteristics:

1. Phytoplankton* -

Sampling Date	Dominant Genera	Algal units per ml
07/24/73	1. Tabellaria	1,115
	2. Asterionella	678
	3. Gloeocystis	241
	4. Cryptomonas	153
	5. Melosira	131
	Other genera	197
	Total	2,515
10/04/73	1. Cyclotella	618
	2. Dinobryon	598
	3. Flagellates	159
	4. Crucigeria	20
	Total	1,395

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/17/73	01	5.1
	02	5.2
	03	3.3
07/24/73	01	8.4
	02	6.2
	03	5.7
10/04/73	01	2.8
	02	3.5
	03	3.5

* The April sample was lost in shipment.

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.012	0.826	0.1
0.050 P	0.062	0.826	15.1
0.050 P + 1.0 N	0.062	1.826	16.4
1.0 N	0.012	1.826	0.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Beltzville Lake was low at the time the assay sample was collected (04/17/73). The significant increase in yield (compared to the control) with the addition of orthophosphorus and the lack of change in yield when only nitrogen was added indicate phosphorus limitation.

The lake data also indicate phosphorus limitation; i.e., the mean N/P ratios were 107/1 or greater, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Pennsylvania National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in May, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Pennsylvania District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads at station B-1, in kg/km^2/year, and multiplying by the ZZ area in km^2.

The flow in Wild Creek (station C-1) is controlled by releases from the Penn Forest and Wild Creek reservoirs which primarily are used for municipal water supplies. The flow in Wild Creek below these

* See Working Paper No. 175.

reservoirs largely is seepage and ground-water recharge and generally measures less than 0.01 m^3/day. Therefore, loading estimates were not prepared for station C-1; however, the results of the analyses of Wild Creek samples are included in Appendix E.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Pohopoco Creek	1,420	67.4
Pine Run	210	10.0
b. Minor tributaries & immediate drainage (non-point load) -	410	19.5
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	65	3.1
Total	2,105	100.0

2. Outputs -

Lake outlet - Pohopoco Creek 1,490

3. Net annual P accumulation - 615 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Pohopoco Creek	115,615	75.9
Pine Run	10,985	7.2
b. Minor tributaries & immediate drainage (non-point load) -	21,615	14.2
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	-	-
e. Known industrial - None	-	-
f. Direct precipitation** -	4,135	2.7
Total	152,350	100.0

2. Outputs -

Lake outlet - Pohopoco Creek 129,130

3. Net annual N accumulation - 22,220 kg.

* See Working Paper No. 175.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Pohopoco Creek	11	895
Pine Run	11	578

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.55	0.16	39.8	5.8

Vollenweider loading rates for phosphorus (g/m²/yr) based on mean depth and mean hydraulic retention time of Beltzville Lake:

"Dangerous" (eutrophic rate)	1.12
"Permissible" (oligotrophic rate)	0.56

V. LITERATURE REVIEWED

Ulanoski, James, 1975. Personal communication (lake morphometry). PA Dept. Env. Resources, Harrisburg.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4224	LAKE NAOMI	445
2	4220	BELTZVILLE DAM	423
3	4222	HARVEY'S LAKE	413
4	4228	STILLWATER LAKE	401
5	4227	POCONO LAKE	389
6	4223	INDIAN LAKE	388
7	3641	ALLEGHENY RESERVOIR	385
8	4229	LAKE WALLENPAUPACK	371
9	4221	CANADOHTA LAKE	369
10	4219	BEAVER RUN RESERVOIR	360
11	4204	CONNEAUT LAKE	307
12	4226	PINCHOT LAKE	256
13	4213	PYMATUNING RESERVOIR	206
14	4216	SHENANGO RIVER RESERVOIR	157
15	4225	ONTELAUNEE DAM	101
16	4201	BLANCHARD RESERVOIR	85
17	4207	GREENLANE DAM	53

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P	INDEX NO
3641	ALLEGHENY RESERVOIR	56 (9)	38 (6)	63 (10)	100 (16)	69 (11)	59 (8)	385
4201	BLANCHARD RESERVOIR	13 (2)	13 (2)	25 (4)	31 (5)	3 (0)	0 (0)	85
4204	CONNEAUT LAKE	44 (7)	63 (10)	69 (11)	56 (9)	34 (5)	41 (6)	307
4207	GREENLANE DAM	6 (1)	6 (1)	19 (3)	13 (2)	3 (0)	6 (1)	53
4213	PYMATUNING RESERVOIR	0 (0)	72 (11)	6 (1)	0 (0)	100 (16)	28 (4)	206
4216	SHENANGO RIVER RESERVOIR	19 (3)	44 (7)	13 (2)	6 (1)	47 (7)	28 (4)	157
4219	BEAVER RUN RESERVOIR	94 (15)	19 (3)	88 (14)	81 (13)	19 (2)	59 (8)	360
4220	BELTZVILLE DAM	88 (14)	25 (4)	94 (15)	94 (15)	34 (5)	88 (13)	423
4221	CANADOHTA LAKE	50 (8)	97 (15)	56 (9)	19 (3)	59 (9)	88 (13)	369
4222	HARVEY'S LAKE	63 (10)	81 (13)	100 (16)	63 (10)	47 (7)	59 (8)	413
4223	INDIAN LAKE	100 (16)	31 (5)	75 (12)	75 (12)	19 (2)	88 (13)	388
4224	LAKE NAOMI	81 (13)	88 (14)	44 (7)	69 (11)	88 (14)	75 (12)	445
4225	ONTELAUNEE DAM	25 (4)	0 (0)	0 (0)	44 (7)	19 (2)	13 (2)	101
4226	PINCHOT LAKE	31 (5)	56 (9)	31 (5)	38 (6)	81 (13)	19 (3)	256
4227	POCONO LAKE	38 (6)	97 (15)	50 (8)	88 (14)	75 (12)	41 (6)	389
4228	STILLWATER LAKE	72 (11)	72 (11)	38 (6)	25 (4)	94 (15)	100 (16)	401
4229	LAKE WALLENPAUPACK	72 (11)	50 (8)	81 (13)	50 (8)	59 (9)	59 (8)	371

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P
3641	ALLEGHENY RESERVOIR	0.016	0.380	414.250	3.700	13.800	0.006
4201	BLANCHARD RESERVOIR	0.064	1.300	453.143	15.187	14.900	0.046
4204	CONNEAUT LAKE	0.023	0.185	402.000	7.567	14.600	0.007
4207	GREENLANE DAM	0.066	1.475	460.222	24.011	14.900	0.020
4213	PYMATUNING RESERVOIR	0.070	0.180	467.750	56.333	7.700	0.008
4216	SHENANGO RIVER RESERVOIR	0.058	0.340	463.555	26.800	14.500	0.008
4219	BEAVER RUN RESERVOIR	0.009	0.835	384.833	5.183	14.800	0.006
4220	BELTZVILLE DAM	0.010	0.815	362.444	4.856	14.600	0.005
4221	CANADOHTA LAKE	0.020	0.130	436.000	19.167	14.100	0.005
4222	HARVEY'S LAKE	0.015	0.160	338.000	5.967	14.500	0.006
4223	INDIAN LAKE	0.008	0.520	400.222	5.211	14.800	0.005
4224	LAKE NAOMI	0.014	0.135	443.333	5.533	8.000	0.005
4225	ONTELAUNEE DAM	0.040	2.150	470.667	11.783	14.800	0.011
4226	PINCHOT LAKE	0.027	0.245	453.000	13.950	11.500	0.008
4227	POCONO LAKE	0.024	0.130	438.800	4.980	13.200	0.007
4228	STILLWATER LAKE	0.015	0.180	449.000	18.233	7.900	0.004
4229	LAKE WALLENPAUPACK	0.015	0.250	394.583	9.617	14.100	0.006

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4220 BELTZVILLE DAM

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 248.6

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4220A1	249.7	3.31	5.27	6.77	6.20	3.99	5.01	3.48	3.77	1.44	1.44	3.82	4.70	4.09
4220A2	129.2	2.28	3.20	4.33	3.85	2.47	3.26	2.01	2.06	1.10	1.15	2.69	3.20	2.67
4220B1	14.0	0.42	0.65	0.96	0.82	0.59	0.65	0.37	0.40	0.18	0.19	0.54	0.65	0.53
4220C1	60.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4220Z2	41.4	0.37	0.54	0.71	0.65	0.48	0.54	0.34	0.34	1.84	0.19	0.45	0.54	0.58

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 248.6
SUM OF SUB-DRAINAGE AREAS = 499.7

TOTAL FLOW IN = 94.73
TOTAL FLOW OUT = 0.0

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4220A1	5	73	8.72	19	12.43				
	6	73	5.18	16	4.84				
	7	73	7.99	17	3.91				
	8	73	4.02	21	2.52				
	9	73	2.14	16	3.40				
	10	73	4.76	16	1.90				
	11	73	2.74	13	2.27				
	12	73	11.02	13	2.69				
	1	74	7.75	15	4.84				
	2	74	6.65	12	3.79				
	3	74	7.73	12	8.78				
	4	74	10.19	9	35.11				
4220A2	5	73	4.59	19	4.56				
	6	73	4.42	16	2.73				
	7	73	3.44	17	2.72				
	8	73	3.05	21	2.12				
	9	73	1.64	18	2.55				
	10	73	2.07	16	1.47				
	11	73	2.29	13	2.15				
	12	73	7.70	13	8.89				
	1	74	4.73	15	3.11				
	2	74	3.94	12	2.92				
	3	74	4.45	12	4.30				
	4	74	5.66	5	8.52				

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4220 BELTZVILLE DAM

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4220B1	5	73	0.93	19	0.99				
	6	73	0.96	16	0.54				
	7	73	0.85	17	0.54				
	8	73	0.62	21	0.40				
	9	73	0.28	18	0.51				
	10	73	0.40	16	0.25				
	11	73	0.74	13	0.49				
	12	73	1.90	13	1.42				
	1	74	1.05	15	0.62				
	2	74	0.85	12	0.59				
	3	74	0.96	12	0.93				
	4	74	1.30	9	2.15				
4220C1	5	73	1.42	19	1.53				
	6	73	0.85	16	0.18				
	7	73	0.62	17	0.31				
	8	73	0.26	21	0.05				
	9	73	0.00	18	0.00				
	10	73	0.00	16	0.00				
	11	73	0.03	13	0.00				
	12	73	1.84	13	0.01				
	1	74	0.93	15	0.23				
	2	74	0.75	12	0.24				
	3	74	0.93	12	1.02				
	4	74	1.42	9	2.61				
4220Z7	5	73	1.47	19	2.12				
	6	73	0.88	16	0.82				
	7	73	1.35	17	0.03				
	8	73	0.59	21	0.42				
	9	73	0.37	18	0.37				
	10	73	0.82	16	0.31				
	11	73	0.48	13	0.46				
	12	73	1.87	13	0.43				
	1	74	1.31	15	0.82				
	2	74	1.13	12	0.65				
	3	74	1.31	12	1.59				
	4	74	1.71	9	3.47				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

422001
40 51 05.0 075 38 06.0
BELTZVILLE DAM
42025 PENNSYLVANIA

11EPALES
3

2111202
0117 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	15 40	0000	8.6		144	58	7.50	10K	0.040	0.200	0.870	0.007
	15 40	0006		11.7		55	7.60	10K	0.030	0.200	0.860	0.003
	15 40	0020	8.2	11.8		53	7.60	10	0.030	0.300	0.860	0.005
	15 40	0035	8.0	11.7		53	7.60	11	0.030	0.300	0.860	0.008
	15 40	0050	8.0	11.7		53	7.60	12	0.030	0.500	0.860	0.005
	15 40	0065	7.9	11.5		53	7.60	14	0.040	0.400	0.870	0.005
	15 40	0080	7.9	11.6		53	7.60	14	0.040	0.400	0.860	0.007
	15 40	0095	7.9	11.5		53	7.60	11	0.040	0.300	0.860	0.004
	15 40	0113	7.8	11.5		53	7.60	10K	0.040	0.300	0.850	0.007
73/07/24	14 05	0000	25.5		168	35	7.20	10K	0.080	0.300	0.440	0.005
	14 05	0005	25.0	8.8		41	7.20	10K	0.080	0.200K	0.420	0.010
	14 05	0020	19.8	5.2		40	6.00	10K	0.120	0.200	0.620	0.005
	14 05	0040	17.1	4.6		35	6.00	10K	0.120	0.300	0.650	0.004
	14 05	0080	11.4	5.6		32	6.10	10K	0.120	0.200K	0.680	0.003
	14 05	0121	8.4	1.3		36	6.10	10K	0.340	0.500	0.540	0.004
73/10/04	09 40	0000	18.8	7.8	168	43	6.70	15	0.060	0.600	0.480	0.006
	09 40	0025	18.7	6.6		43	6.30	13	0.060	0.500	0.490	0.005
	09 40	0035	18.5	5.6		44	6.30	13	0.060	0.500	0.520	0.004
	09 40	0050	17.2	6.4		45	6.00	14	0.050	0.600	0.680	0.004
	09 40	0070	16.4	6.6		46	6.00	14	0.080	0.400	0.610	0.005
	09 40	0095	14.5	6.6		50	6.10	20	0.280	0.700	0.270	0.006
	09 40	0115	11.9	6.8		54	6.20	24	0.470	0.800	0.040	0.006

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/01/27

422001
40 51 05.0 075 38 06.0
BELTZVILLE DAM
42025 PENNSYLVANIA

11EPALES
3

2111202
0117 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	15 40	0000	0.010	5.1
	15 40	0006	0.014	
	15 40	0020	0.008	
	15 40	0035	0.010	
	15 40	0050	0.009	
	15 40	0065	0.008	
	15 40	0080	0.010	
	15 40	0095	0.008	
	15 40	0113	0.013	
73/07/24	14 05	0000	0.011	8.4
	14 05	0005	0.013	
	14 05	0020	0.012	
	14 05	0040	0.010	
	14 05	0080	0.008	
	14 05	0121	0.012	
73/10/04	09 40	0000	0.011	2.8
	09 40	0025	0.009	
	09 40	0035	0.009	
	09 40	0050	0.009	
	09 40	0070	0.012	
	09 40	0095	0.016	
	09 40	0115	0.027	

21

STORET RETRIEVAL DATE 75/01/27

422002
40 52 10.0 075 35 57.0
BELLEVILLE DAM
42025 PENNSYLVANIA

11EPALES
3

2111202
0071 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	16 25	0000	9.8		120	55	7.40	10K	0.040	0.300	0.850	0.006
	16 25	0006	9.7	11.8		55	7.30	10K	0.030	0.200	0.850	0.003
	16 25	0015	9.6	11.6		55	7.40	10K	0.030	0.200	0.850	0.003
	16 25	0025	9.5	11.6		55	7.50	10K	0.030	0.200K	0.850	0.005
	16 25	0035	9.2	11.7		52	7.40	10K	0.030	0.200	0.850	0.004
	16 25	0050	8.5	11.3		52	7.50	10K	0.030	0.200K	0.800	0.002
	16 25	0067	8.2	11.2		50K	7.50	10K	0.040	0.200K	0.850	0.003
73/07/24	14 55	0000	26.2		132	41	7.40	10K	0.070	0.400	0.410	0.005
	14 55	0005	25.2	5.8		41	7.10	10K	0.090	0.300	0.420	0.005
	14 55	0020	20.5	6.2		39	6.20	10K	0.100	0.300	0.710	0.004
	14 55	0040	17.0	4.4		38	6.00	10K	0.130	0.300	0.720	0.003
	14 55	0071	12.4	3.2		37	6.00	10K	0.180	0.300	0.630	0.002
73/10/04	10 30	0000	19.2	8.0	180	44	6.50	13	0.060	0.600	0.470	0.004
	10 30	0025	19.0	7.4		44	6.30	14	0.050	0.300	0.490	0.004
	10 30	0035	18.5	6.2		44	6.20	10	0.120	0.300	0.590	0.005
	10 30	0040	17.7	6.0		45	6.20	10K	0.090	0.200	0.670	0.012
	10 30	0055	17.0	6.2		46	6.10	10K	0.110	0.200	0.800	0.007
	10 30	0075	16.1	4.6		48	6.20	12	0.170	0.300	0.650	0.009

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 73/01/27

422602
40 32 10.0 075 35 57.0
BELIZVILLE DAM
42025 PENNSYLVANIA

11EMALES 2111202
3 0071 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	16 25	0000	0.011	5.2
	16 25	0005	0.009	
	16 25	0015	0.008	
	16 25	0025	0.008	
	16 25	0035	0.009	
	16 25	0050	0.009	
	16 25	0067	0.010	
73/07/24	14 55	0000	0.010	5.2
	14 55	0005	0.012	
	14 55	0020	0.013	
	14 55	0040	0.011	
	14 55	0071	0.011	
73/10/04	10 30	0000	0.010	3.5
	10 30	0025	0.010	
	10 30	0035	0.011	
	10 30	0040	0.020	
	10 30	0055	0.017	
	10 30	0075	0.009	

23

STORET RETRIEVAL DATE 73/01/27

422003
40 32 35.0 075 34 00.0
BELTZVILLE DAM
42089 PENNSYLVANIA

TIEPALES
3

2111202
0046 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	16 55	0000	11.3		120	60	7.00	10K	0.040	0.200	0.990	0.004
	16 55	0006	11.1	11.5		58	7.40	10K	0.030	0.200K	0.920	0.004
	16 55	0015	10.9	11.4		55	7.30	10K	0.030	0.200K	0.920	0.005
	16 55	0025	10.5	11.2		55	7.30	10K	0.030	0.200K	0.940	0.003
	16 55	0042	10.3	11.0		55	7.40	10K	0.030	0.200K	0.980	0.003
73/07/24	15 25	0000	26.2		108	41	6.40	10K	0.080	0.300	0.410	0.004
	15 25	0005	26.2	8.6		41	7.00	10K	0.060	0.200	0.400	0.004
	15 25	0020	22.6	8.2		41	6.50	10K	0.080	0.300	0.620	0.005
	15 25	0036	18.4	7.4		41	6.30	10K	0.090	0.300	0.850	0.005
73/10/04	11 15	0000	19.1	7.4	156	42	6.40	11	0.100	0.400	0.530	0.006
	11 15	0020	19.0	6.4		44	6.30	11	0.080	0.200	0.520	0.007
	11 15	0028	18.7	7.5		43	6.30	11	0.080	0.200	0.560	0.006

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	16 55	0000	0.011	3.3
	16 55	0006	0.011	
	16 55	0015	0.011	
	16 55	0025	0.010	
	16 55	0042	0.012	
73/07/24	15 25	0000	0.012	5.7
	15 25	0005	0.011	
	15 25	0020	0.014	
	15 25	0036	0.021	
73/10/04	11 15	0000	0.009	3.5
	11 15	0020	0.010	
	11 15	0028	0.009	

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/02/03

422DA1
40 50 55.0 075 38 30.0
POHOPOCO CREEK
42129 7.5 LEHIGHTON
O/HELTZVILLE DAM
END OF OLD MILL RD BELO DAM SPILLWAY
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	18	51	0.730	0.350	0.011	0.005K	0.005K
73/06/26	19	45	0.630	0.560	0.054	0.006	0.010
73/07/07	20	07	0.610	1.730	0.096	0.005K	0.010
73/08/14	19	30	0.630	0.150	0.048	0.005K	0.010
73/09/18	21	40	0.580	0.390	0.038	0.009	0.010
73/10/16	07	10	0.550	0.250	0.073		0.005
73/11/25	14	05	0.588	0.800	0.068	0.008	0.015
74/01/05	13	30	0.630		0.028	0.005K	
74/02/03	13	45	0.780	0.100K	0.020	0.010	0.010
74/02/17	10	25	0.756	0.300	0.045	0.005	0.015
74/03/03	14	00	0.860	0.200	0.030	0.010	0.010
74/03/17	11	43	0.830	0.100	0.020	0.010	0.015
74/04/21	14	00	0.630	0.300	0.035	0.005	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4220A2
50 53 10.0 075 32 20.0
POMOPOCO CREEK
42 7.5 POMOPOCO MTN
T/BELTZVILLE DAM
UNDRY RD 13015
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	17 15		0.730	0.670	0.022	0.005K	0.010
73/06/26	21 00		0.950	1.470	0.044	0.006	0.020
73/07/07	21 00		0.960	0.520	0.029	0.005K	0.010
73/08/14	14 00		1.000	0.130	0.022	0.007	0.025
73/09/18	22 30		0.790	0.460	0.036	0.009	0.040
73/10/16	08 00		1.040	0.200	0.017	0.005K	0.015
73/11/25	15 10		1.120	0.800	0.032	0.005K	0.015
74/01/05	14 45		1.120	0.100K	0.008	0.005K	0.005
74/02/03	14 30		1.200	0.200	0.010	0.010	0.010
74/02/17	11 20		1.280	0.100	0.015	0.005	0.010
74/03/03	14 55		1.260	0.100	0.020	0.010	0.010
74/03/17	12 22		1.100	0.500	0.022	0.005	0.022
74/04/21	15 00		1.010	0.200	0.015	0.005K	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

422081
40 53 10.0 075 37 07.0
PINE RUN
42 7.5 POHOPOCO MTN
T/BELTZVILLE DAM
SEC RD T441 BRDG .8 MI FROM MOUTH
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	17 52		0.046	0.220	0.005K	0.005K	0.005K
73/06/26	20 00		0.056	1.600	0.040	0.005K	0.010
73/07/17	20 25		0.060	1.130	0.052	0.006	0.010
73/08/14	20 00		0.078	0.100K	0.050	0.012	0.012
73/09/18	22 00		0.110	0.220	0.022	0.005K	0.015
73/10/16	07 30		0.038	0.150	0.025	0.005K	0.015
73/11/25	14 25		0.104	0.250	0.016		0.010
74/01/05	13 45		0.128	0.100K	0.008	0.005K	0.005K
74/02/03	14 01		0.124	0.200	0.010	0.010	0.010
74/02/17	10 45		0.064	0.400	0.055	0.005	0.015
74/03/03	14 15		0.084	0.100K	0.015	0.010	0.010
74/03/17	11 55		0.128	2.900	0.045	0.005K	0.025
74/04/21	14 20		0.068	0.100	0.010	0.010	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4220C1
40 53 28.0 075 33 44.0
WILD CREEK
42 7.5 POHOPOCO MTN
T/BELTZVILLE DAM
SEC RD T435 BRDG .3 MI BELO WILD CR DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	18 08		0.016	0.440	0.024	0.005K	0.010
73/06/26	20 45		0.060	1.100	0.039	0.009	0.020
73/07/17	20 45		0.060	2.900	0.100	0.005K	0.010
73/08/14	20 20		0.024	0.100K	0.019	0.007	0.007
73/09/18	22 15		0.500	0.400	0.023	0.017	0.020
73/10/16	08 30		0.315	0.150	0.016	0.005K	0.050
73/11/25	14 40		0.368	0.300	0.016		
74/01/05	14 15		0.064	0.100K	0.012	0.005K	0.005K
74/02/03	14 20		0.080	0.500	0.015	0.005	0.005
74/02/17	11 00		0.080	0.100K	0.015	0.005	0.015
74/03/03	14 30		0.084	0.100	0.015	0.010	0.010
74/03/17	12 15		0.072	0.100	0.015	0.005K	0.010
74/04/21	14 45		0.040	0.200	0.005K	0.005K	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED